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Effects of response card use on student participation and academic achievement in an elementary classroom

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Effects of Response Card Use on Student Participation and Academic Achievement in an Elementary Classroom

(TITLE)

BY

Christina J. Diel

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Abstract

This study compared the effectiveness of hand raising with the use of response cards in a sixth-grade general education classroom during whole-group social studies instruction. Dependent variables included the frequency of active student responding during instruction and student performance on both weekly quizzes and maintenance tests. Participants included 14 sixth-grade general education students (6 boys and 8 girls), ranging in ages from 11 to 12. An ABAB design was utilized to evaluate the effectiveness of the experimental condition. Participants were exposed to the hand raising condition during weeks 1 and 3 and the response card condition during weeks 2 and 4. During the hand raising condition, the teacher used a traditional lecture approach that entailed asking questions and requesting students to answer on an individual basis by raising their hands. In the response card condition, students were asked questions in the same manner as in the hand raising condition; however, all students were asked to respond by writing answers on their response cards and holding them up. Results indicated that the use of response cards was effective in increasing the frequency of active student responding during instruction and improving student performance on both weekly quizzes and maintenance tests administered three weeks later.

Effects of Response Card Use on Student Participation and Academic Achievement in an Elementary Classroom

State and federal mandates, such as the No Child Left Behind Act, are holding today's educators increasingly accountable for students' levels of academic achievement. As a result, educators must identify methods to improve the academic achievement of all students (Christle & Schuster, 2003). One possible method for accomplishing this is to increase the amount of active student participation, also referred to as academic learning time or academic engaged time, taking place in the classroom (Christle & Schuster, 2003; Gardner, Heward, & Grossi, 1994; Narayan, Heward, Gardner, Courson, & Omness, 1990).

In 1963, Carroll hypothesized that learning is determined by the relationship between time spent on learning and time needed for learning. He suggested that two variables contribute to the amount of time students spend learning. These include opportunities to learn, or the amount of time set aside for a specific task or subject area, and learner perseverance, or the amount of time the student spends actively engaged in the material (Carroll, 1963). Further, three variables contribute to the time needed for learning. These include aptitude, or the time needed to learn under ideal instructional conditions, the ability to understand instruction, and the quality of instruction (Carroll, 1963). The factors in Carroll's model have gradually become more precisely defined and systematically researched. Although Carroll's model helped to bring attention to the importance of time spent and time needed for learning to occur, the primary variable of concern for research has been active student participation (Gettinger, 1986).

Educational research demonstrates that academic achievement is positively correlated with the amount of active student participation occurring in the classroom (Christle & Schuster, 2003; Gardner et al., 1994; Leach & Ingram, 1989; Narayan et al., 1990), meaning that when all other variables are controlled, students who respond many times during a lesson learn more than students making few responses (Heward, Gardner, Cavanaugh, Courson, Grossi, & Barbetta, 1996). Research also demonstrates that active student participation, such as reading words and answering questions, has a stronger correlation with achievement than does passive responding, such as paying attention and listening to the teacher (Narayan et al., 1990). In a literature review conducted by Bloom (1976), consistent correlations were found between student engagement and achievement. Bloom reported a mean correlation of .49 between engagement and achievement and concluded that student engagement accounted for about 20 percent of the variation in achievement.

The most extensive empirical study that focused directly on academic learning time and academic achievement was a six-year project known as the Beginning Teacher Evaluation Study (BTES) (Fisher, Berliner, Filby, Marliave, Cahen, & Dishaw, 1980). This study was conducted in second and fifth grade classrooms and directly measured students' academic learning time and level of achievement on reading and math activities. Academic learning time was defined as the amount of time a student spends engaged in an academic task that he/she can perform with high success. For example, the amount of time a student works on addition problems, after he/she has mastered the concept of addition, would be considered active learning time. Results revealed a consistent positive relationship between academic learning time and achievement in

reading and math. Further, the variable of academic learning time accounted for between 11 and 20 percent of residual variance in achievement.

Despite numerous research studies that have supported a positive correlation between active student participation and academic success, active learning methods are not widely employed in classrooms (Christle & Schuster, 2003). Descriptive studies of students' behavior in classrooms have indicated that student participation most often occurs in the form of passive attending to the teacher (Heward, 1994). This generally entails the teacher presenting information verbally and asking students to respond to questions, one at a time. High-achieving students typically raise their hands and are called upon, increasing their amount of active student participation, while lower achieving students seldom raise their hands, holding their amount of active student participation to a minimum (Heward, 2000; Maheady, Mallette, Harper, & Sacca, 1991).

In a study conducted by Hall, Delquadri, Greenwood, and Thurston (1982), researchers observed classrooms in six elementary schools. They reported that although 75% of the school day was allocated for academic instruction, only 25% of the day was spent in active student responding. Sixteen percent of the day was spent writing, followed by talking and reading silently, which composed 4% and 3% of the day, respectively. Further, students spent less than 1% of the school day actively responding in any of the following ways: reading aloud, answering questions, asking questions, and reciting.

Several strategies, such as class-wide peer tutoring, computer-assisted instruction, and self-directed learning, have been successful in increasing active student responding and academic success (Narayan et al., 1990). However, these strategies are not easily

applicable to teacher-led whole group instruction. Teachers need strategies that are not only effective, but also time and cost efficient, easy to implement, adaptable to various content areas, and enjoyable for both themselves and students (Narayan et al., 1990). Strategies used by teachers that do meet these criteria include choral responding, timed trials, guided lecture notes, and response cards (Armendariz & Umbreit, 1999; Christle & Schuster, 2003; Heward, 1994). Choral responding requires each student in the class to emit an oral response simultaneously (Heward, 1994). In timed trials, students are given a set time limit to practice academic skills (Christle & Schuster, 2003). For example, students may be given five minutes to practice multiplication facts using flash cards. Guided lecture notes are handouts prepared by the teacher which give an outline of the lecture and leave spaces for students to write in key facts, concepts, and/or relationships (Heward, 1994).

Response cards, which are the focus of the present study, are cards or signs that are held up simultaneously by all students in a classroom to display their responses to a question or problem presented by the teacher (Heward, 1994). The teacher immediately responds to the students' answers by providing the correct answer and academic remediation, if necessary (Kellum, Carr, & Dozier, 2001). This strategy may be more appropriate than choral responding, timed trials, and guided lecture notes due to its ease of implementation, opportunities for immediate teacher feedback, and minimal classroom noise level.

Two basic types of response cards are reported in the literature. These include preprinted response cards and write-on response cards (Heward, 1994; Heward, 1997). Preprinted response cards may contain letters, words, or objects which represent a

student's answer/response. Examples of these cards include: yes/true, no/false, numbers, colors, molecular structures, and parts of speech (Heward, 1997). Preprinted cards can be used in a number of ways. First, students may be presented with a variety of different cards, from which they may choose one to hold up as their answer (Heward, 1994; Heward, 1997). For example, in a language arts class, students may be given several preprinted cards which have various parts of speech written on them. When asked a question, the student holds up the card corresponding to his/her answer. A second approach is to provide each student with one card containing several answers (Heward, 1994; Heward, 1997). Each student then holds up his/her card and points to his/her answer. For example, in a science class, students may be provided with a preprinted card on which the words "true" and "false" are printed. When responding to a question, the student holds up his/her card and points to the word corresponding to his/her answer.

Write-on response cards are a second type of response card (Heward, 1994; Heward, 1997). These include small chalkboards or dry-erase boards on which students write their answers and erase between learning trials.

Both preprinted response cards and write-on response cards have unique advantages (Heward, 1994; Heward, 1997). An advantage of preprinted cards is that higher rates of responding can be generated because students do not have to spend time writing down and erasing answers (Heward, 1994). Secondly, the chance of students answering questions incorrectly can be minimized by providing the students with only a couple of preprinted cards initially. The number of cards can then be increased gradually as students develop skills. Preprinted cards may also have greater visibility than write-on response cards due to the size and legibility of students' writing (Heward, 1994).

An advantage of write-on response cards is that curriculum material with multiple correct answers can be used (Heward, 1994). Write-on response cards also have the advantage of allowing students to emit creative responses. Further, write-on cards require a more difficult response by asking students to recall an answer rather than simply recognize an answer. Due to the unique advantages of each type of response card, the classroom setting, content area, and specific lessons to be taught must be evaluated in determining which type of response card would be most effective and easiest to implement.

Research supports the use of response cards in elementary, secondary, and postsecondary educational settings. In a study conducted by Gardner, Heward, and Grossi (1994), an ABAB reversal design was utilized to compare two methods of student participation, including hand raising and response cards, in a fifth-grade classroom during whole-class science instruction. In both conditions, sessions began with a quiz over the previous lesson. Questions on the quizzes were read to the students to control for a wide range in students' reading abilities. During the second part of the sessions, the teacher followed scripted lessons in which new information was presented via an overhead projector. These scripted lessons specified the content to be covered, questions to be asked, and all responses that would be considered correct. After each new fact or concept was presented, the teacher would cover the overhead projector and ask the students a question. Students responded by raising their hands or holding up response cards, depending on the condition they were in for that session. Results indicated that in the response card condition, students responded to the teacher an average of 21.8 times per 30-minute lesson, as compared to an average of 1.5 times per lesson during the hand

raising condition. In addition, students in the response card condition performed better on next-day quizzes and 2-week review tests when compared to the hand raising condition. During the response card condition, the overall mean score was 70% correct on both the next-day quizzes and 2-week review tests, while the overall mean score during the hand raising condition was 57% correct on next-day quizzes and 49% correct on 2-week review tests. Further, the majority of students indicated that they preferred the use of response cards to hand raising.

Cavanaugh, Heward, and Donelson (1996) evaluated the effects of two review techniques on secondary students' recall of science lesson content. The two techniques included an active review condition and a passive review condition. Participants in the study were 23 ninth-grade students, eight of whom had been formally identified as having learning disabilities, behavior disorders, mental retardation, or were participating in supplementary programs for students at risk for high school dropout. The dependent variables were students' scores on next-day and weekly tests. Each 30-minute science lesson included three sections. These sections included teacher lecture, hands-on demonstration or experiment, and teacher-led review of the lesson content. In the passive review condition, the teacher read and explained key points on an overhead projector, while students listened. During the response card condition, the teacher used an overhead projector to review key points that were presented in a fill-in-the-blank format. Students were then prompted to write the missing word on their response cards and hold up their cards. Next, the teacher presented the correct answer and provided praise or correction, before moving on to the next item. Results demonstrated that the mean next-day test scores were higher for items covered during the active review condition for 13 of the 15

general education students, as well as all 8 of the special education students. Student performances on weekly tests were also higher for items that had been reviewed with response cards.

In a study conducted by Marmolejo, Wilder, & Braimey (2004), researchers evaluated the effects of the use of response cards on student quiz scores and student participation in an upper division undergraduate psychology course. Participants in this study included 27 college students majoring in psychology. Conditions in this study included: baseline, response card, and standard lecture. During baseline, the instructor used his/her typical lecture method that involved asking students questions and having them respond orally. In both the response card and standard lecture conditions, the instructor lectured and asked six prewritten questions. During the response card condition, students were given preprinted response cards containing the letters: A, B, C, D, T, and F. These cards were held up in response to multiple choice and true/false questions. During the standard lecture condition, students responded by raising their hand to the questions, "Who thinks A is correct? Who thinks B is correct?" etc. In all conditions, a quiz containing multiple choice and true/false questions was given at the end of the lecture. Results indicated that quiz scores were highest in the response card condition, with a mean quiz score of 73.4%, followed by mean quiz scores of 63.6% and 61% in the standard lecture and baseline conditions, respectively. In addition, 54% of individual students exhibited improved quiz scores during the response card condition. Results also revealed that the response card condition produced the largest number of responses, with a mean number of responses of 7.2. Mean number of responses produced by the standard lecture condition and baseline condition were 2.6 and 2, respectively.

Further, analysis of individual responses indicated that 96% of students increased their responding during the response card condition.

Several benefits may result from the use of response cards in the classroom (Narayan et al., 1990; Armendariz & Umbreit, 1999). Response card use has been shown to increase the frequency of participation per student, as well as the number of students who participate. In addition, use of response cards may also increase test/quiz scores. In a study conducted by Narayan et al., (1990), researchers evaluated the effects of hand raising and write-on response cards on the active participation of students. The setting for the study was a fourth-grade classroom during large-group social studies instruction. Results demonstrated that the rate of active student response during instruction was much higher with response cards than with hand raising (Narayan et al., 1990). In addition, most students performed better on daily quizzes during the response card condition. Further, 19 of the 20 students in the class preferred the response cards over hand raising.

The use of response cards has also been shown to decrease off-task and disruptive behavior. In 1999, Armendariz and Umbreit evaluated the effects of response card use on disruptive behavior in a third-grade general education classroom during math instruction. Conditions in this study included hand raising and write-on response cards. Disruptive behavior was the only dependent variable measured. Using a time sampling recording system, researchers scanned the classroom 10 times, at the end of each 2-minute interval. Results indicated that each student had fewer intervals of disruptive behavior during the response card condition than during the hand raising condition. The mean decrease in disruptive behavior for the entire class was 86%.

Although previous research has supported the use of response cards in various educational settings and for a number of purposes, several limitations in the research literature exist. First of all, little maintenance data has been collected to assess students' long-term retention after using response cards (Cavanaugh et al., 1996; Gardner et al., 1994; Kellum et al., 2001). It is unknown; therefore, whether the benefits of using response cards persist over time. In addition, few studies have evaluated the effectiveness of response cards in upper elementary classrooms in rural, public schools. Most studies have used participants attending public schools in suburban and urban areas (Cavanaugh et al., 1996; Gardner et al., 1994; Narayan et al., 1990). In general, schools in rural areas may have smaller class sizes than schools in suburban and urban areas. A smaller class size may provide opportunities for more active student responding for each student, therefore influencing the effectiveness of the use of response cards.

The purpose of the present study was to compare the effectiveness of hand raising with the use of response cards in a sixth-grade general education classroom during social studies instruction. Dependent variables included the frequency of active student responding during instruction and student performance on weekly quizzes and maintenance tests. More active student responding during instruction was expected for students in the response card condition than for students in the hand raising condition. Further, students in the response card condition were expected to perform better both on weekly quizzes and during later maintenance tests of the information.

Method

Participants

Fourteen sixth-grade students (6 boys and 8 girls) enrolled in general-education classes in a rural public elementary school were the participants for this study. All students were Caucasian, of low to middle economic status, and ranged in age from 11 to 12 years. The students were all in the same social studies class and their teacher was a 53 year-old man who had 30 years of teaching experience.

The social studies' teacher rated each student in the class as either "above average," "average," or "below average" based on his perceptions of the students' academic achievement. Due to the difficulty of observing all fourteen students, four students were randomly selected to be the target of classroom observations. The first student selected was an 11-year old girl rated as "above average" in achievement. Students 2 and 3 were rated as "average" achievers in the classroom. Student 2 was a 12-year-old girl, and Student 3 was a 12-year-old boy. The final student was an 11-year-old girl who was rated as "below average" in achievement by the teacher.

Design

An ABAB design was used to evaluate the effectiveness of response cards versus raising hands to answer questions in a sixth-grade general education classroom.

Hand raising condition. During the hand raising condition, the teacher used a traditional lecture approach and required that students raise their hands to indicate they wanted to respond orally to an open-ended question asked by the teacher. The teacher acknowledged correct answers and for incorrect answers, the teacher either asked other students to respond or provided the correct answer.

Response card condition. In the response card condition, the teacher asked questions in the same manner as in the hand raising condition, but all students in the classroom were given the opportunity to respond by writing down their answers on their response cards and then holding up the cards for the teacher to view. The teacher prompted students to write answers by stating at the end of each question, "Write your answer." Students were given time to write their answers and then they held up their cards when prompted by the teacher to "Hold up your card." The teacher acknowledged correct answers and for incorrect answers, the teacher stated the correct response.

Materials

To record their responses during the response card condition, all 14 students in the social studies' classroom were provided with a piece of white laminated particle board (11 in. by 8.5 in.). In addition, each student received a dry erase marker, as well as a square piece of felt (5 in. by 5 in.) to serve as an eraser.

Paper and pencil were also used to record responses to four weekly quizzes and two maintenance tests. At the end of each week, all students in the class took a written quiz over social studies' material presented earlier that week. Each quiz was developed by the primary investigator and reviewed by the classroom teacher to ensure that quiz questions were appropriate. Quizzes consisted of eight, short-answer questions randomly selected from questions asked by the teacher during lecture that week. For example, one question asked on a quiz was, "Who was Anne Frank?" The two maintenance tests were also developed by the primary investigator and reviewed by the classroom teacher. These tests consisted of 10 questions randomly selected from

questions asked by the teacher during lecture. Five quiz questions from each condition were randomly selected to be included on the corresponding maintenance test.

Dependent Variables

Dependent variables included percentage of active responding in both conditions by the four target students, and weekly quiz and maintenance test scores for the entire class.

Active responding. In the hand raising condition, active responding was measured by recording the number of times each target student raised his or her hand at least head high in response to a teacher-posed question. In the response card condition, active responding was measured by recording the number of times a target student wrote down his or her answer and held up a response card in response to a question by the teacher.

For both the hand raising and response card conditions, a percentage of active responding was calculated for each target student by dividing each student's number of active responses by the total number of opportunities to respond. Each of the four target students, therefore, had two active responding percentage scores: One score represented each student's percentage of active responding during the hand raising condition and the other score represented each student's percentage of active responding during the response card condition.

Weekly quiz scores. For the entire class, each student's percentage correct on each weekly quiz was calculated by dividing the number of quiz questions answered correctly by the total number of questions (i.e., 8) on each quiz. Each student in the class had four weekly quiz scores.

Maintenance test scores. For the entire class, each student's percentage correct on each of two maintenance tests was calculated by dividing the number of maintenance test questions answered correctly by the total number of questions on each maintenance test (i.e., 15). Each student in the class had two maintenance test scores.

Procedure

One week prior to the beginning of data collection, the teacher was trained in the response-card method by the primary investigator. Included in this training was how to instruct students to use response cards, as well as what feedback to give students. The primary investigator also provided students in the classroom with a 20-minute training session on how to use response cards.

Data collection took five weeks. During week 1 and week 3, students participated in the hand raising condition five times each week with their teacher during their regular 50-minute social studies class. The response card condition was presented during week 2 and week 4 during the same 50-minute social studies class.

During each social studies class, two observers sat in the classroom and recorded active responding by the four target students. One of these observers was the primary investigator and the other was a teacher's aide who had been trained on the data collection procedure during practice sessions in the classroom. Both observers independently recorded the number of times each target student raised her/his hand at least head high during the hand raising condition. Both observers also recorded each time a target student held up a written response during the response card condition. For active student responding, interobserver reliability was calculated on a daily basis by dividing the total number of times both observers agreed that an active response had been

emitted by the total number of agreements plus number of disagreements; this resulted in percentage agreements for active student responding that ranged from 92% to 100%. The overall mean percentage agreement for active responding was 96%. Because the teacher's aide was unaware of the hypotheses for this research study, only her data were used for analyses.

At the end of each week, all students in the classroom were administered an 8-item quiz over material presented during lecture that week. Questions on each quiz were randomly selected from questions asked during lectures by the teacher. All students in the class completed each quiz while they were seated at their desks.

Three weeks after students were first exposed to the hand raising condition (i.e., week 4), the entire class was given a maintenance test covering material presented during weeks 1 and 3. The second maintenance test covered information presented during weeks 2 and 4 of the response card condition and was given three weeks (during week 5) after the response card condition was first presented. Questions on the maintenance test were randomly selected from questions asked during lectures by the teacher and all students in the classroom completed the maintenance tests while seated at their desks.

Both observers independently calculated each student's percent correct on each weekly quiz and maintenance test. Interrater reliability was calculated for each quiz and test by dividing the total number of times both observers agreed that a correct response had been recorded by the number of agreements plus disagreements and ranged from 97% to 100%. The overall mean percentage agreement for the quiz and test scores were 99%. The quiz and test scores calculated by the teacher's aide were used in data analyses.

Results

The percentage of time that four target students raised their hands and used response cards to respond to a question asked by their teacher during lectures in a social studies class was calculated. Dependent variables for the present study also included four weekly quiz scores and scores on two maintenance tests for the entire class of students.

Active Student Responding

Figure 1 indicates that all four of the target students had a higher percentage of active responding during the response card condition than during the hand raising condition. Data analysis confirmed that active student responding during the response card condition ($M = 64.50$, $SD = 16.66$) was significantly higher than active student responding during the hand raising condition ($M = 26.25$, $SD = 6.29$), $t(3) = 6.92$, $p = .003$ (one-tailed).

As shown in Figure 1, variability of active responding existed among the four target students. Student 3, who was rated as "average" in achievement by the teacher, demonstrated the highest percentage of active responding during both conditions. This student was very talkative and eager to answer questions throughout the study. Student 4, who was rated as "below average" in achievement by the teacher, had the second highest percentage of active responding during the response card condition, as well as the largest increase in active responding from the hand raising condition to the response card condition. This student may have been more comfortable responding during the response card condition. Student 1 was rated as "above average" in academic achievement and had the third highest percentage of active responding. Student 2 had the lowest

percentage of active responding in both conditions and was rated as "average" in achievement by the teacher. This student was hesitant to respond throughout the study.

Weekly Quiz Scores

Table 1 presents the weekly quiz scores for each student in the classroom. The overall mean scores for students who took both weekly quizzes during the hand raising condition were 68.33 and 48.89; the corresponding mean quiz scores for the response card condition were 75.00 and 60.00. Data analysis indicated that the average score on quizzes during the response card condition ($M = 66.43$, $SD = 24.05$) was significantly higher than the average score on quizzes during the hand raising condition ($M = 56.43$, $SD = 20.61$), $t(13) = 2.03$, $p = .03$.

Maintenance Test Scores

Maintenance test scores obtained by each participant during the fourth and fifth weeks of the study are presented in Table 2. Inspection of Table 2 indicates that all but one student who took both maintenance tests scored higher on the maintenance test over material presented during the response card condition than they did on material presented during the hand raising condition. Data analysis confirmed that for students who took both maintenance tests (n = 9), scores on the maintenance test related to the response card condition ($M = 62.78$, $SD = 27.74$) were significantly better than the students' scores on the maintenance test related to the hand raising condition ($M = 42.22$, $SD = 19.86$), $t(8) = 2.03$, $p = .015$.

Discussion

The present study compared the effectiveness of hand raising with the use of response cards in a sixth-grade general education classroom in a rural setting. Results

indicated that the use of response cards was effective in increasing the frequency of active student responding during instruction and in improving student performance on weekly quizzes and maintenances tests. These findings are consistent with previous studies which have supported the use of response cards for promoting active student participation and academic achievement (Cavanaugh et al., 1996; Gardner et al., 1994; Marmolejo et al., 2004; Narayan et al., 1990). In addition, this study provides new information regarding the benefits of response cards over time. Previous studies collected data only on same-day or next-day quizzes (Cavanaugh et al., 1996; Narayan et al., 1990; Marmolejo et al., 2004), weekly tests (Cavanaugh et al., 1996), and two-week review tests (Gardner et al., 1994). Maintenance test scores in the present study suggest that the learning benefits of using response cards can persist for at least a three-week period of time. This is an important finding because long-term retention of academic material is an important indicator of what has actually been learned (Fisher et al., 1980).

The procedure of this study also varied from previous research. In this study, participants were exposed to two conditions (i.e. hand raising and response card) during separate time periods. However, in other studies, participants were exposed to three conditions (i.e. baseline, response card, and standard lecture) (Marmolejo et al., 2004) or were exposed to both conditions during the same time period (Cavanaugh et al., 1996). Results from previous research and the present study provide evidence that response cards can be successful in a variety of experimental conditions.

The number of student participants and the classroom setting are other differences between this study and previous research. Previous studies have been completed in suburban and urban areas and have used class sizes of at least 20 students. It was

unknown whether or not using response cards in a smaller class would provide opportunities for more active student responding or if the same learning benefits would be found in a smaller class of students. The present study was completed in a rural area with a sample of only 14 students in the classroom. Results from this study suggest that the use of response cards can be beneficial in improving active student responding and test scores in rural areas with smaller class sizes.

This study demonstrated several benefits of the use of response cards. First, the use of response cards provided the teacher with an objective method of assessing student performance in the classroom. During the traditional hand raising method, a teacher can assess only a sample of student learning during class time because only one student at a time actively responds to a question. However, use of the response card method allows the teacher to quickly evaluate all student responses (Armendariz & Umbreit, 1999; Cavanaugh et al., 1996; Gardner et al., 1994; Marmolejo et al., 2004; Narayan et al., 1990). This enables the teacher to give frequent feedback to students, a critical element in the learning process (Leach & Ingram, 1989). Further, the teacher gains the necessary information to determine if additional and/or modified instruction is necessary or if the class is ready to move on to new material. Another benefit of the use of response cards is its relatively low cost. All materials for this study, including the laminated particle board, felt, and dry-erase markers, were purchased for less than $25.00. The use of response cards is also easy to implement. It requires little teacher preparation before class and no teacher time, such as grading, following class.

Although no data were collected on student and teacher satisfaction on the use of response cards, many students reported that they enjoyed using the cards. The teacher

stated on several occasions that he preferred the response cards over the hand raising method due to the increased number of student responses and the opportunity to assess the performance of several students at once. After the study was completed, the teacher continued to use the response cards in social studies, as well as in other classes. In addition, the teacher stated that he and the other sixth-grade teacher in the school planned to use write-on response cards for the following academic year.

Although the use of response cards in the present study yielded positive results on quiz and test scores, an important limitation of this study, along with a small sample size and short duration, is that several students were absent at various times during the study. As a result, these students received less instructional time than other students in the class, possibly missing important information that was later asked on a quiz or test. Additionally, only 9 of 14 students completed both the hand raising and response card maintenance tests. How student absences affect the results of this study is unknown.

Another limitation of this study involves teacher instruction during the response card condition. Although the teacher prompted students to write answers and hold up their cards by stating, "Write your answer" and "Hold up your card", not all students wrote down a response. It appeared that students did not believe they were required to make a response. This differs from previous studies in which students were required to make a response using their response cards. However, this may have been an improvement from previous research because it makes responding during the hand raising and response card conditions more similar by allowing students to respond to questions only when they want to.

Overall, the present study adds support to the literature on the effectiveness of response cards in the classroom. Future research needs to examine the effects of using response cards in subject areas other than social studies, such as spelling and grammar. It would also be beneficial to study the use of response cards with the same group of students across various subject areas or with various teachers.

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Table 1

Mean Weekly Quiz Score for Each Student During Hand Raising (HR) and Response Card (RC) Conditions

Student	HR I	RC I	HR II	RC II
1	60	100	60	60
2	80	100	40	80
3	60	100	60	80
4	80	100	Absent	60
5	60	40	20	Absent
6	40	20	Absent	80
*7	100	100	40	100
*8	80	40	60	20
*9	80	100	Absent	80
*10	40	40	20	60
11	Absent	60	20	20
12	Absent	50	40	Absent
13	40	60	60	40
14	100	100	80	80
Mean	68	72	45	63

Note: Student numbers listed with an * represent students who were selected for data collection on active responding.

Table 2

Mean Maintenance Test Score for Each Student During Hand Raising (HR) and Response Card (RC) Conditions

Student	HR	RC
1	40	70
2	50	70
3	40	90
4	Absent	80
5	20	Absent
6	Absent	50
*7	50	100
*8	50	25
*9	Absent	90
*10	10	40
11	20	30
12	40	Absent
13	40	50
14	80	90
Mean	40	65

Note: Student numbers listed with an * represent students who were selected for data collection on active responding.

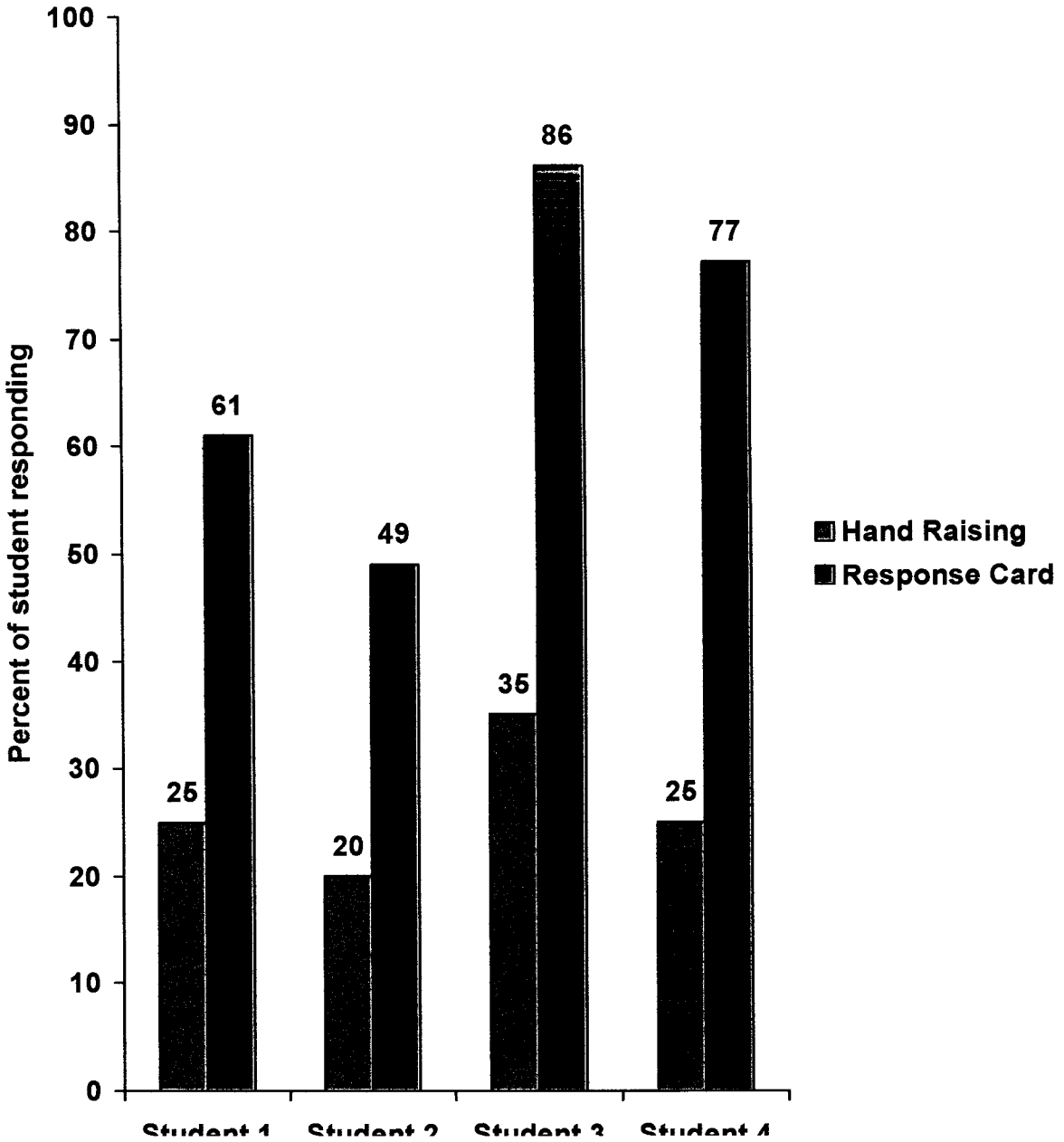
Table 3

Mean Quiz and Maintenance Test Scores for Students with No Absences vs. Students with Absences in the Hand Raising (HR) and Response Card (RC) Conditions

	HR Quizzes	RC Quizzes	HR Maintenance Test	RC Maintenance Test
Students with no absences	61.2	72.5	42.2	62.7
Students with absences	48.5	61.0	30.0	73.3

Figure Caption

Figure 1. Percent of student responding by target students during hand raising and response card conditions.


100
90
80
70
60
50
40
30
20
10
0
Percent of student responding
61
49
86
77
25
20
35
25
Hand Raising
Response Card